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SPECIFICATION FOR FLANGES FOR WAVEGUIDES

PART 1 GENERAL REQUIREMENTS AND TESTS

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NEW DELHI 110002

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Indian Standard

SPECIFICATION FOR FLANGES FOR WAVEGUIDES

PART 1 GENERAL REQUIREMENTS AND TESTS

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(*Continued on page* 2)

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Indian Standard

SPECIFICATION FOR FLANGES FOR WAVEGUIDES

PART 1 GENERAL REQUIREMENTS AND TESTS

0. FOREWORD

0.1 This Indian Standard (Part 1) was adopted by the Indian Standards Institution on 30 August 1983, after the draft finalized by the Microwave Components and Accessories Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 It has been decided to bring a series of standards on flanges for waveguides. This standard (Part 1) is the first in this series and covers general requirements and tests for flanges for waveguides for use in electronics and telecommunication equipment. The subsequent parts will cover the detail requirements for flanges for ordinary rectangular waveguides, medium flat rectangular waveguides, flat rectangular waveguides, square waveguides, circular waveguides, etc.

0.3 The object of establishing series of standards on flanges for waveguides is to specify:

a) the requirements necessary to ensure compatibility and, as far as practicable, interchangeability; and

b) the tolerances necessary to ensure adequate electrical performance.

0.4 While preparing this standard, assistance has been derived from the following:

IEC Pub 154-1 (19) 'Flanges for waveguides : Part 1 General requirements and measuring methods' issued by the International Electrotechnical Commission.

JSS 53100 'General requirements for flanges for waveguides' issued by the Ministry of Defence, Government of India.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

---

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard (Part 1) prescribes general requirements and methods of test for flanges for waveguides for use in electronics and telecommunication equipment.

1.2 Although it primarily covers requirements for flanges in which the locating holes are drilled after the flanges are mounted on the waveguides, it also covers requirements for flanges in which the locating holes are drilled before the flanges are mounted on the waveguide.

2. TERMINOLOGY

2.0 For the purpose of this standard, the terms and definitions given in IS : 1885 (Part 55)-1981* shall apply in addition to the following.

2.1 Type Test — Tests carried out to prove conformity with the requirements of this standard. These are intended to prove the general qualities and design of a given type of waveguide.

2.2 Acceptance Tests — Tests carried out on samples selected from a lot for the purposes of the acceptance of the lot.

2.2.1 *Lot* — All waveguides of the same type, category and rating manufactured by the same factory during the same period, using the same process and materials.

2.3 Routine Tests — Tests carried out on each flange for waveguide to check requirements which are likely to vary during production.

3. CLIMATIC CATEGORIES

3.1 For the purpose of climatic tests, the flanges shall belong to one of the following three categories:

Severity	*Category* 1	*Category* 2	*Category* 3
Dry heat	+100°C	+100°C	+85°C
Cold	−65°C	−40°C	−10°C
Rapid change of temperature	−65°C to +100°C	−40°C to +100°C	−10°C to +85°C

NOTE 1 — Category 1 will apply to flanges for waveguides used in aviation.

NOTE 2 — Category 2 will apply to flanges for waveguides used on ground equipment (fixed or mobile).

NOTE 3 — Category 3 will apply to flanges for waveguides used for general purpose in laboratory.

---

*Electrotechnical vocabulary: Part 55 Microwave components and accessories.

4. MATERIALS, CONSTRUCTION AND WORKMANSHIP

4.1 Material — The materials shall be aluminium, aluminium alloy, copper, copper alloy, magnesium-base alloy, silver alloy, silver lined copper, or silver lined copper alloy as specified below.

4.1.1 *Aluminium* — Grade TIC conforming to IS : 738-1977*.

4.1.2 *Aluminium Alloy* — Grade HT 20 conforming to IS : 738-1977*.

4.1.3 *Copper* — Pure high conductivity electrolytic tough pitch (ETP) copper conforming to IS : 191-1967†.

NOTE — As an alternative material to this, oxygen free high conductivity copper and DHP-1 conforming to IS: 191-1967†, may be permitted and this is recommended for use only where high conductivity copper would present manufacturing problems such as embrittlement during heat treatment.

4.1.4 *Brass* 70/30 — Alloy No. 1 conforming to IS : 407-1981‡.

4.1.5 *Brass* 90/10 — Under consideration.

4.1.6 *Magnesium* — Under consideration.

4.1.7 *Magnesium Alloy* — Under consideration.

4.1.8 *Silver* — Commercial standard silver having a nominal composition of 92·5 percent silver and 7·5 percent copper with maximum impurity of 0·1 percent.

4.1.9 *Lined* — To special orders only. Copper, brass and silver as specified above shall be used for lining.

4.2 Construction, Workmanship and Finish

4.2.1 The flanges for waveguide shall be manufactured and processed in a careful and workman like manner in accordance with good engineering practice.

4.2.2 The flanges for waveguide shall be free from defects of a nature that may interfere with all its applications. The flanges for waveguide shall be uniform in composition and thickness. These shall be smooth on both faces and free from internal and external mechanical imperfections and shall have a clean, bright appearance in accordance with good commercial practice. In addition, the interior surface of the aperture of the flanges for waveguide shall be free from burrs, die marks, chatter marks, dirt, grease, scales, splinters and oxides.

---

*Specification for wrought aluminium and aluminium alloy drawn tube (for general engineering purposes) (*second revision*).

†Specification for copper (*second revision*).

‡Specification for brass tubes for general purposes (*third revision*).

5. DESIGNATION OF FLANGES FOR WAVEGUIDES

5.1 The flanges for waveguides shall be designated as follows:

a) By a letter relating to the basic construction, namely

P — plain pressurizable
C — choke pressurizable
U — plain unpressurizable

b) followed by a letter for the type according to drawing. Flanges with the same letter and of the same waveguide size can be mated;

c) the letter and number of the waveguide for which the flange is designed shall be given in the last.

Example — The designation CBR 100 denotes a choke flange of type B, for rectangular waveguide R 100 [*see* IS : 4493 (Part 2)-1981*].

6. MARKING

6.1 Each flange for waveguide shall be legibly and indelibly marked with the following information, in the order given below:

a) Type designation;
b) Manufacturer's name or trade-mark or both, and
c) Date code (*see* IS : 8186-1976†).

NOTE 1 — Additional marking, if any, shall be specified, so as not to cause confusion with other marking and shall be well separated from it.

NOTE 2 — For smaller sizes where such marking is not practicable the marking shall be as prescribed in the relevant detail specification.

NOTE 3 — The method of marking shall not be detrimental to the performance of the flanges for waveguide.

6.1.1 The package of the flanges for waveguide shall contain information about the category and reference to relevant specification in addition to those specified in **6.1**.

---

*Specification for hollow metallic waveguides : Part 2 Ordinary rigid rectangular waveguides.

†Marking codes for values and tolerances of resistors and capacitors.

6.2 The flanges for waveguides or their packings may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

7. PACKAGING

7.1 Flanges for waveguides shall be preserved and packed, so as to afford adequate protection against corrosion, deterioration and physical damage during transit.

8. TESTS

8.1 Conditions of Tests

8.1.1 *General* — The tests shall be carried out on the flanges for waveguides as received from the manufacturer or supplier.

8.1.2 *Selection of Samples* — The samples for testing shall be so selected as to be representative of each category and the relevant type of flanges for waveguide.

8.1.3 *Atmospheric Conditions for Testing*

8.1.3.1 Unless otherwise specified, all tests shall be carried out under standard atmospheric conditions for testing as specified in IS : 9000 (Part 1)-1977*.

8.1.3.2 Before measurements are made, the flanges for waveguide shall be stored at the measuring temperature for a time sufficient to allow the entire flanges for waveguide to reach this temperature.

8.1.3.3 When measurements are made at a temperature other than the specified temperature, the results shall where necessary, be corrected to the specified temperature. The ambient temperature at which the measurements are made shall be stated in the test report.

---

*Basic environmental testing procedures for electronic and electrical items : Part 1 General.

8.2 Classification of Tests

8.2.1 *Type Tests* — The procedure for type approval shall be in accordance with IS : 2612-1965*.

8.2.1.1 *Number of samples* — Unless otherwise specified, the manufacturer shall submit 8 flanges in each material and of each size manufactured.

8.2.1.2 *Grouping of samples* — As specified in the relevant detail specification.

8.2.1.3 *Sequence of type tests* — As specified in the relevant detail specification.

8.2.2 *Routine Tests* — As specified in the relevant detail specification.

8.2.3 *Acceptance Tests* — As specified in the relevant detail specification.

8.3 Mechanical Tests

8.3.1 *Visual Examination* — Flanges for waveguide shall be uniform in composition. There shall be no burrs, cracks, die marks, dirt, grease, scale or splinters.

Contact surfaces shall have a clean appearance in accordance with good engineering practice.

Compliance shall be checked by visual inspection.

8.3.2 *Locating Holes* — At least four holes shall be precision drilled (locating holes). These shall be clearly indicated in the drawings. These locating holes shall be those which are the nearest to the narrow side of the flanges for waveguide.

Holes which are not intended as locating holes may be less accurately located than are the locating holes, but must be of correspondingly larger diameter to ensure mating of the flanges.

8.3.3 *Shank Diameter of Fixing Bolts Used for Location* — The following nominal shank diameters are standardized:

mm
8·0
6·35
5·0
4·17
4·0
3·0

---

*Recommendation for type approval and sampling procedures for electronic components.

The tolerance on nominal shank diameter shall be according to fit h8 (*see* IS : 919-1963*).

NOTE — This value has been standardized for flanges originally designed to take bolts with 7·94 mm nominal shank diameter. However, clearance and positional tolerance for the general purpose flanges are so chosen that bolts with 7·94 mm as well as 8·0 mm shank can be used without violating the electrical requirements.

8.3.4 *Relation Between Shank and Locating Hole Diameter* — For each individual flange, the proper mating of two flanges is ensured by specifying:

a) the location of the holes and the tolerances thereon; and

b) the nominal diameters of the shanks of coupling bolts with the appropriate fit.

For the relation between the tolerance on hole position and the fit of the bolt in the hole, the following applies:

a) the tolerance in both directions on the hole position (δ) shall be specified for each individual flange;

b) the nominal shank diameter (d) shall be specified for each individual flange;

c) the minimum clearance between maximum shank diameter (d_{max}) and minimum hole diameter (D_{min}) shall be calculated from:

$$D_{min}-d_{max}=2\sqrt{2}\delta$$

NOTE — The multiplication factor of $\sqrt{2}$ takes into account the displacement in two directions perpendicular to each other.

d) the tolerance on the hole diameter shall be of the class 9 tolerance of the system for fits and limits.

8.3.4.1 For practical reasons the following fits are recommended (*see* IS : 919-1963*).

Type of Flange	*Range of Size*	*Fit*
Rectangular flange for type R waveguide	R 12 and larger	Under consideration
	R 14 — R 32	A9
	R 40 — R 70	B9
	R 84 and smaller	C9
Rectangular flange for type F waveguide	F 22 — F 32	B9
	F 40 and smaller	C9
Circular flanges	All	B9

NOTE — When electrical requirements make it necessary, the hole position tolerance may be reduced and the hole diameter fit to the shank should be improved accordingly.

---

*Recommendations for limits and fits for engineering (*revised*).

8.3.5 *Overall Dimensions and Thickness of Flanges* — The values quoted are taken from established designs and it should be noted that these values are based in general on the use of brass, but for other materials other values might be more appropriate.

8.3.6 *Surface Roughness of Contact Area of Flanges* — The surface roughness shall be measured as described in Appendix A. The nominal value of surface roughness shall not exceed 1·6 μm (rms).

8.3.7 *Flatness of Contact Area* — The flatness of contact area shall be better than the values given below:

Range of Sizes	*Requirement* mm
R 12 and larger dimensions	Under consideration
R 14 — R 26	0·05
R 32 — R 140	0·02
R 180 and smaller dimensions	Under consideration

8.3.8 *Perpendicularity of the Axis of the Holes* — The perpendicularity of the axis of the holes to the contact area of the flange shall be 90±0·25 degrees.

8.3.9 *Positioning of the Holes* — Positioning of the holes shall be based on the theoretical symmetry lines of the inside cross-section of the waveguide.

8.3.10 *Perpendicularity of the Contact Area* — The perpendicularity of contact area of the flange to the axis of the aperture for the waveguide shall be 90±0·5 degrees.

8.3.11 *Shape of Aperture* — The requirements for the dimensions of the aperture in the flange only apply to that part which affects mating between the flange and the waveguide.

The nominal dimensions of the flange aperture shown in the tables are equal to the nominal outside dimensions of the tubes according to the specification for waveguides.

The tolerances for the dimensions of the aperture will depend on the materials and assembly methods and shall therefore be agreed between customer and the manufacturer.

Note — For socket-type, the front-aperture shall have dimensions within the tolerances specified for the inside cross-section of the appropriate size of waveguide

8.3.12 *Positioning of the Holes for Unmounted Flanges* — Positioning of the holes shall be based on the symmetry lines of the aperture of flange.

8.4 Climatic Tests

8.4.1 *Dry Heat* — The flanges for waveguides shall be subjected to dry heat test in accordance with IS : 9000 (Part 3/Sec 3)-1977[*]. The temperature severity shall be the maximum of the temperature specified for the climatic category applicable. The duration of the test shall be 16 hours. Mechanical tests listed in **8.3** shall be carried out after this test.

8.4.2 *Cold* — The flanges for waveguides shall be subjected to Cold test in accordance with IS : 9000 (Part 2/Sec 3)-1978[†]. The temperature severity shall be the minimum of the temperature specified for the climatic category applicable. The duration of the test shall be 2 hours. Mechanical tests listed in **8.3** shall be carried out after this test.

8.4.3 *Rapid Change of Temperature* — The flanges for waveguides shall be subjected to this test in accordance with IS : 9000 (Part 14/Sec 1)-1978[‡]. The temperature severity shall be the maximum and the minimum temperatures specified for the climatic category applicable. Mechanical tests shall be carried out after this test.

APPENDIX A

(*Clause* 8.3.6)

SURFACE ROUGHNESS MEASUREMENT

A-1. The method for determining roughness height is described in Fig. 1, where r is average deviation from the mean line, y is the ordinate of the curve of the profile, and l is the length over which the average is taken. A, B, C, D, etc, represent the deviation in micro-metres of the true surface from the mean surface at uniform intervals along the profile normal to the lay, or in the direction which gives the maximum value.

Then roughness height average:

$$y = \frac{1}{l}\int_{x=0}^{x=l} \left[y \right] dx$$

Basic environmental testing procedures for electronic and electrical items:

[*] Part 3 Dry heat test, Section 3 General.

[†] Part 2 Cold test, Section 3 General.

[‡] Part 14 Change of temperature, Section 1 Rapid change of temperature by two-chamber method.

A-2. An approximation of the above may be obtained by adding r increments without regard to sign and dividing the sum by the number n of the increments taken.

$$r = \frac{A+B+C+D\ldots\ldots\ldots}{n}$$

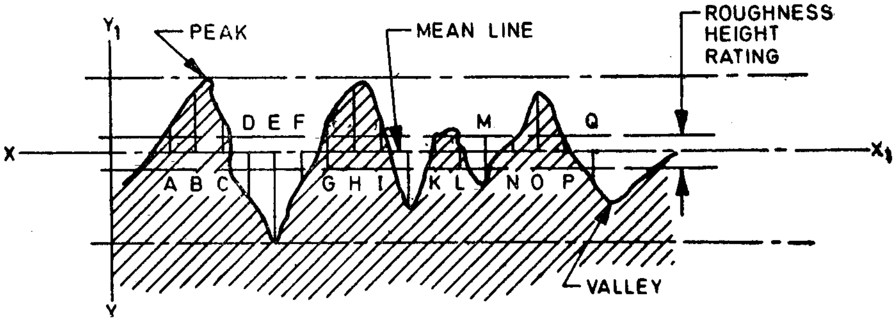

Fig. 1 True Surface Profile